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ABSTRACT

One of the working papers in the final report of the Arizona Board of Regents' Task Force on Excellence, Efficiency and Competitiveness examines the needs of rural Arizona for educational services and proposes means for the provision of those services that can be offered by public universities. Seven sections look at the demography of rural Arizona, Arizona Interagency Telecommunication Network, university telecommunication capability, technical information services, Arizona Cooperative Extension Service, attendance of rural youth in colleges and universities, and consultative and technical services. A significant portion of the state's population will continue to live in nonurban areas. It is important that cooperative programs be developed to enhance the likelihood that rural youth and adults participate more fully in postsecondary education. A statewide communications network could offer enrichment programming at all school levels, advanced placement courses in high schools not providing them, and upper division and graduate courses in a coordinated program by the three public universities. Two recommendations are that: (1) the Board of Regents, the Board of Trustees for Community Colleges, and the Board of Education create a joint commission to continue to examine the needs of the nonurban areas of the state for educational services; and (2) the Arizona Telecommunication Cooperative pursue means of expanding the outreach of the universities and community colleges. Four tables are included. (SM)

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UNIVERSITY SERVICE TO RURAL ARIZONA

ROBERT MACVICAR

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In the past 60 years, Arizona has shifted from a predominantly rural state to one in which, in 1988, 76 percent of the population resides in two metropolitan areas, Phoenix and Tucson. Its economy, largely agriculture and mining and smelting in 1940, has been converted into one largely dependent on high technology manufacturing and service industries. Estimates of future growth predict that this transformation will continue with nearly 80 percent of the population concentrated in the two metropolitan areas by 2000.

There are substantial reasons, however, to support the belief that the "other Arizona" consisting of the regions outside the metro-areas offer opportunity for economic growth if they are provided the educational, social and cultural systems needed for the creation of employment opportunities. Agricultural and mineral industries will continue to be significant components of the economy but cannot be expected to provide employment for all of the current population. Tourism and the associated service occupations provide for modest growth, but such employment is largely in the lower wage job classifications. Significant economic development in rural Arizona will require a more highly educated work-force and access to the services provided by the state universities.

The provision of greater access to upper division and graduate programs in the rural counties is an important component for providing both educational opportunity for Arizona residents and a pool of adequately educated personnel to staff expanded or newly entering industry. Given the population dispersion and the likelihood of small demand for the product by local industry, the option of creating, as has been done in more populous states, more baccalaureate level institutions is not justifiable except in the metropolitan areas. This is especially true if the goal is access to more specialized education at the graduate level. If Arizona is to deal effectively with the issue of the economic development of the rural counties, it must find effective and cost-efficient means to deal with these problems of providing post-secondary educational services.

Increasingly, higher education (and particularly research universities) are being viewed as a resource beyond the entity for providing adequately educated personnel. They are the source of much of the basic and applied research. Their faculties are sought as consultants and technical advisors. Their laboratories and computer centers often are unique

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resources. Their libraries provide access to on-line retrieval to national and international data bases. Particularly for the newly emerging "high-tech" small businesses, their ability to use these resources may be crucial to the success of the venture.

In this document, the needs of rural Arizona for educational services will be examined and means proposed for the provision of those that legitimately can be offered by public universities.

THE DEMOGRAPHY OF RURAL ARIZONA

During the past half century, the demographic character of Arizona has changed significantly. The census of 1930 revealed a state with modest population, ranking 43rd in the order of the then 48 states. By 1950, the change to a more urbanized population had begun, but Arizona still ranked only 40th in rank of population. During the succeeding decades to 1980 the process accelerated and during the 1970-1980 period Arizona was second among the states in rate of increase in population largely achieved by a substantial net in-migration. The population by county for the period 1930 to 1980 and estimates for 1985, 1990 and 2000 are presented in Table 1 together with the percentage each represents of the state total.

Examination of the current and projected demographic pattern for the state also reveals that there are essentially only two counties (Maricopa and Pima) capable of maintaining additional institutions of higher education at the baccalaureate level. The third largest incorporated city in Arizona is Yuma with a population in 1985 of 46,455. Flagstaff, the site of Northern Arizona University, is fourth at 38,600, with a significant portion of the population university students. Three cities, one of which is in the Phoenix Metropolitan area, are between 20,000 and 29,999 and nine, one of which is in metro-Phoenix, are between 10,000 and 19,999. With the exception of cities which are part of Metropolitan Phoenix no city of 10,000 or more is in the same county with another. Given the geographic area of the state, the result is a dispersion of those persons who might benefit from higher education. They must commute long distances from their homes or face relocating to the site of either a community college or one of the three public universities. An unknown but significant percentage of these persons are unable or unwilling to commit themselves to either of these options.

Recognizing the dispersed nature of the non-urban population of the state, both Regents policies and Executive Department and Legislative funding practice have encouraged the three universities to provide "extended learning" opportunities. Northern Arizona University has been particularly responsive to this opportunity and has developed an extensive outreach program, particularly in the field of teacher education. The University of Arizona has had for many years a close relation with Ft. Huachuca by providing upper division programming leading to baccalaureate degree completion. More recently, Northern Arizona University has sought to extend educational programs to Yuma in collaboration with Arizona Western College. The UA also seeks funding to extend its programming off-base from Fort Huachuca to nearby Sierra Vista and NAU wants to expand its Yuma efforts to a more fully developed "Center". With the development of these two centers all cities with more than 20,000 population

will have access to baccalaureate programs in either a public or independent institution.

This will, however, leave a large percentage of the non-urban population without access to upper division and graduate educational opportunity. What has come to be called "distance education" (more accurately, learning while at a distance from the campus program) can, however, provide opportunity if the requisites for its implementation are in place. Those conditions include:

- A state-wide plan for higher education must be developed through coordinated action by the Regents, the universities, the Board of Directors for Community Colleges and the community college districts and the State Department of Education.

- University policies and procedures must encourage faculty to participate and create the possibility of efficient use of advanced technology.

- University policies and procedures must accept the likelihood that students will receive instruction from more than one institution of the Arizona university system.

- Regential policies must be modified to encourage and reward inter-institutional cooperation in providing distance learning.

- State policies and practices must encourage the efficient use of the state-wide telecommunications network.

- State appropriations will need to be provided for the additional costs of the telecommunication network to meet the requirements for upper division and graduate course dissemination.

- Individual students must be encouraged to use less-conventional means of instruction including the use of computers, video-recorders, video and audio equipped off-campus classrooms, video-cassettes, cable-casting.

- Inter-institutional cooperation among the three universities and the nine community college districts and Navajo Community College will be required if the goal of broad access to essentially all the population of the state is to be achieved.

- Appropriate means must be developed and implemented to assume adequate and equitable cost-sharing of the telecommunication system among the various institutions and the users.

ARIZONA INTERAGENCY TELECOMMUNICATION NETWORK

The Department of Administration of the State of Arizona provides telecommunication services to the various agencies of the state, at the present time using the facilities of the common carriers (e.g. Mountain Bell) to provide the connections. This system is less responsive than desirable to agency needs and is unable to provide for the projected demand of a growing population and hence requirements for voice and data transmission. The current system, moreover, does not provide for transmitting digitalized television signals for video teleconferencing or for

extended learning. Data transmission needs of state agencies and particularly future university needs for high speed data transmission to regional and national super-computer centers are likewise not met by the current system.

In response to this situation, the Department of Administration initiated a study of the current telecommunication system in 1986. Based on an analysis of the system management, economic, agency productivity and technology issues, the consultant recommended that the State proceed to procure and operate a telecommunications system. As a follow-up on this proposal, the State commissioned Fluor Technology, Inc. to technically design a system appropriate to the current and projected needs of the State agencies. To meet the objectives of the study, Fluor contracted with Booz, Allen and Hamilton to provide a survey of current needs and known projected needs of the State agencies. Fluor also was assisted by Telecommunications Service International, a firm specializing in traffic studies, which analyzed the needs for telecommunications services.

With this information in hand, Fluor then proceeded to design a cost-effective, Interagency Telecommunications Network (ITN) and submitted its proposal to the Department of Administration. The ITN transmission technology proposal provides a system flexible enough to provide access to voice, data and video transmission. The "backbone" of the ITN would provide for high capacity capability between the major nodal elements at Winslow, Flagstaff, Phoenix, Coolidge, Tucson and Douglas by digitalized microwave transmission. It is proposed that the system would initially be designed to carry voice and data and be capable of expansion to provide two way video/audio transmission for educational users. Several community college districts (Mohave, Navajo, Yavapai, Cochise) have in place or are planning telecommunication networks to serve their respective areas. These and others (Pinal Community Colleges) can be corrected to be "backbone" at modest cost, particularly if coordination in the planning phase is adequate. Presumably, in a longer range future the ITN "backbone" can be expanded to Yuma and Kingman. For the present, these locations and other major centers will be served by lines leased from an appropriate carrier. This would not permit the use of full-color, two way, broadcast quality television to these sites but might permit, after business hours, a more limited quality one-way video, two way audio linkage.

UNIVERSITY TELECOMMUNICATION CAPABILITY

Arizona State University and the University of Arizona have made extensive use of telecommunication for extended learning in their respective metropolitan areas and the University of Arizona has a microwave link to Fort Huachuca. In the Phoenix area ASU has used Interactive Television Fixed System (ITFS) to provide access to industrial subscribers of its programs. In Tucson, the University of Arizona has ITFS capability. Both universities have well equipped production capability for originating one way video, two way audio to remote sites. Both are participants in National Technology University, a nation-wide consortium of universities providing off-campus institutions in the area of engineering and technology via satellite transmission. Both have up-link and down-link satellite transmission capability. Current satellite

charges are such that a significant population of users is required in order to permit the efficient use of this technology from a cost viewpoint.

Northern Arizona University has, at present, more modest capability for originating telecommunications for instructional purposes. It is contemplated, however, to use space on the NAU campus for the Flagstaff node of the state telecommunication network. The campus has been provided with a sophisticated internal network and hence the potential for originating live programming is present with modest augmentation in equipment and the provision of technical staff to operate the originating equipment and handle the switching.

It should be noted that several of the community college districts have developed means to use video-telecommunications for serving their clientele. Both Maricopa and Pima districts have a highly developed system. Mohave, Apache and Yavapai districts have systems in operation and hope to expand them. The opportunity for university-community college collaboration in serving students seeking upper division and graduate courses is potentially significant.

TECHNICAL INFORMATION SERVICES

Outside the libraries of the Phoenix and Tucson metropolitan areas and Flagstaff, no major technical collections exist, but the University of Arizona, Arizona State University and Northern Arizona University have extensive collections. Every county of the state has one or more local libraries linked via telephone to a centralized service coordinated by the Extension Division of the Arizona State Library and Archives. The Tucson Public Library is the central node for provision of technical information services including access to national databases; inter-library loan services are provided by the Phoenix Public Library. There is an inward WATS service using an 800 number that provides access to their service.

The University Libraries at ASU, UA and NAU all are staffed to provide access to their collections and services for persons off-campus. Individuals may use the library collections on all three campuses by contacting an appropriate administrator for in-library use. Reproduction services are available on a fee-for-use basis. The three university book collections are also available via the state-wide inter-library loan system. Arizona State University has implemented the most fully developed system of library extension services in its Fee-based Information and Resource Service Team (FIRST). This program provides the following services: computer database searching, custom research service, document delivery, and translation.

ARIZONA COOPERATIVE EXTENSION SERVICE

Arizona is served at the county level by the Cooperative Extension Service, a Division of the College of Agriculture of the University of Arizona. This function was created by the Smith-Lever Act of the Federal Congress in 1916 and is jointly funded by Federal funds through the U.S. Department of Agriculture, the State General Fund and by resources (some in kind) provided by county governments. In addition to its historic provision of technical service to production agriculture, the growing "high tech" aspects of modern animal and

plant science makes technical information service to the providers of agricultural inputs a growing aspect of the programs. In addition, the University of Arizona operates the Veterinary Diagnostic Laboratory for the state.

ATTENDANCE OF RURAL YOUTH IN COLLEGES AND UNIVERSITIES

An examination of the tendency of rural youth to take advantage of the opportunities provided for post-secondary education was made by the graduates of the high school class of 1986. Data available from the reports of the State Department of Education, the Community College Board and the three public universities were analyzed to determine to the degree feasible the "college going rate" of this population in every Arizona county. The basic data is presented at the end of this report in a series of tables as follows:

- Table 2, High School Graduates, 1986, by Arizona County of Origin
- Table 3, Community College Enrollments of First-time Entering Freshmen, Fall 1986
- Table 4, University Enrollment, First-time Entering Freshmen, Fall 1986

An examination of the data presented in Table 2 reveals that 71.94 percent of the high school graduates in 1985-86 originated in the two counties of Maricopa and Pima, somewhat less than the 1985 estimate of 75.9 percent of the total population. Conversely, 28.06 percent of the high school graduates of this year lived in the more rural counties of the state.

In terms of attendance, the community colleges enrolled a total of 120,719 Arizona residents in Fall 1986. Of these students 67,685 were residents of the Maricopa County District and 19,916 of the Pima District for a total of 87,601 from the two urban counties or 72.56 percent of the total. This does not recognize that included in the 8,256 students unassigned as "out of district" are some from urban areas enrolled in the rural community colleges. It is believed from discussion with the community college administrators that most of the out-of-district students are actually from the rural areas since the total out-of-district enrollments in the Maricopa and Pima College Districts is 2,218 and almost all of them come from rural areas of the state. The actual number of urban students enrolled in the rural districts can not be inferred from the data available but is believed to be relatively small.

Examination of this data would lead one to the conclusion that the community colleges are serving the non-urban population in proportion to their percentage of the total population. The percentage of the population outside the two metropolitan areas in 1985 was 24.1 and the percentage of total community college enrollments outside the two metropolitan districts was 25.4.

If, however, one examines the percentage of 1985-86 high school graduates who are reported by colleges as having enrolled the following Fall semester, a somewhat different status is evident. For Maricopa County district, 4,930 high school graduates of the prior year enrolled in the Fall semester 1986 for the first time. This represents 32.6 percent of the total graduates of the 1985-86 year. The comparable figure for Pima County is 25.9 percent. Again,

these percentages are potentially in error by virtue of movement of first-time students into and out of these districts. From the rest of the state, a total of 7,729 persons graduated from high school in the preceding year and an estimated 1,210 students enrolled in the community colleges the following fall semester, which provided a 15 percent "going rate".

The high schools of origin for the Fall semester, 1986 freshmen class in the three universities are:

County	Students	Percentage
Maricopa	3,136	57.27%
Pima	1,270	23.19%
All others	1,070	19.54%

The number and percentage of high school graduates from the preceding year from the fifteen counties are:

County	Graduates	Percentage
Maricopa	15,127	54.91%
Pima	4,695	17.04%
All others	7,729	28.05%

Thus the rural population of high school graduates of the preceding year attending the public universities of the state is significantly less than is true for the two metropolitan areas.

What is not known is the county of origin of the more than 2,000 students who left Arizona to enroll as freshmen in universities outside the state. It seems likely, however, that a higher percentage of this population comes from the more affluent segment of the two urban counties than from rural Arizona.

It has long been recognized that proximity to higher educational opportunity is a major factor in determining whether or not a student attends an institution of higher education. The unique population of Arizona with a relatively large population of American Indians and Hispanics also contributes to the lower percentage of participation from rural counties.

CONSULTATIVE AND TECHNICAL SERVICES

Every university provides consultative and technical services to Arizonans, both urban and rural. Much of this is on an individual basis, but each university also provides such services through various organized units.

Regents' as well as institutional policy encourages faculty to engage in consultation with clients with certain restrictions designed to protect the institutions and consulting organizations. No formal reports of such services are prepared but anecdotal evidence is supportive of the view that most of this consultation is for agencies and companies in the metropolitan areas. Travel time required to deal with clients in areas of the state remote from the location of the faculty member is a barrier for which no easy solution is apparent. Institutional encouragement to render such service is impacted by the fact that those most requested are also heavily committed to instructional and research duties.

Greater use of telecommunications might facilitate provision of such consultative services. For example, all the county offices of the Cooperative Extension Service are linked by computer terminals to the central office on the campus of the University of Arizona. The University is seeking to establish a video-capability with its major research and extension center near Maricopa.

Consulting services to small businesses operated by American Indian entrepreneurs and tribal enterprises is offered by Northern Arizona University's Center for American Indian Economic Development. This entity has a limited staff and budget and hence is able to deal with only a few clients at any one time. They believe that if additional resources were provided it would be possible to assist not only a larger number of businesses but to provide more helpful assistance. Northern Arizona University also cooperates with the Federal Small Business Administration in providing generalized assistance to small businesses, most of which are in rural communities. Here again, limited resources provide for only a small portion of the potential clientele. The Bureau of Business and Economic Research focuses on northern and rural Arizona in its studies. It responds to requests for information relative to population trends and the economic environment of the rural areas, with focus on the Northern counties.

Arizona State University's College of Business provides a number of services to small businesses but at the present limits most of its activities to the Phoenix metropolitan area. The Hahn Center for Entrepreneurship and Innovation is an interdisciplinary unit in the College of Business that provides conferences and seminars for small business managers. It proposes to initiate in 1988-89 a facility to provide "incubator" service to a limited number of newly organized enterprises. In order to utilize this resource, an enterprise in rural Arizona would need to relocate or begin its development in Tempe. The Hahn Center also sponsors the New Venture Development Council which provides opportunity for entrepreneurs to meet and discuss problems of mutual interest. The Council also conducts seminars dealing with issues crucial to the growth of emerging companies.

The Karl Eller Center for the Study of the Private Market Economy of the University of Arizona provides focus in programing students for entrance into small and emerging enterprises. It sponsors the semi-annual Venture Forums which are available to the owners/managers of emerging firms. The Division of Economic and Business Research prepares analysis on economic trends and assists managers of small business enterprises to use micro-computers for planning purposes. Participants in this program are taught how to develop their own forecasting models and use other applications of market planning methodology.

SUMMARY

A significant portion of the population of Arizona now live and will continue to live in the non-urban areas of the state. The location of the three state universities, two in the metropolitan areas of Phoenix and Tucson, and projections of future population growth makes it unlikely that the needs of the non-urban areas can be effectively served except by an expanded out-reach program by the existing universities. Such expansion should deal with the need for educational programs, particularly at the upper division and graduate level and information and consultation services to enhance the competitiveness of business and industry and cultural enrichment.

The universities, the regional community colleges and the public schools should develop cooperative programs to enhance the likelihood that rural youth and adults participate more fully in post-secondary education.

Expansion of the use of telecommunications by the development of a state-wide communications network that would include interactive video capability should be pursued with the goal of placing such service throughout the state within five years. This network should have as a major goal providing services to rural Arizona by:

- Offering enrichment programming at the elementary, middle and high schools level in schools,
- Offering opportunity to students in small high schools to take courses for which demand is small or teachers are unavailable,
- Offering advanced placement courses in high schools not providing such opportunities to talented students.
- Offering upper division and graduate courses in a coordinated program by the three public universities, with emphasis on areas of significant demand.

The three universities and the Extension Division of the State Library, Archives and Public Records should seek means of facilitating access to information and consultative resources by individuals and entities located in rural Arizona.

RECOMMENDATIONS

- The Board of Regents, the Board of Trustees for Community Colleges and the Board of Education should create a joint commission to continue to examine the needs of the non-urban areas of the state for educational services.
- The Arizona Telecommunication Cooperative should continue to pursue means of expanding the outreach of the universities and the community colleges through joint planning and execution of programs serving both schools and individuals. The Arizona Department of Administration as the agency responsible for the state-wide telecommunications network should assist in the development of an education telecommunications network providing television and computer access among the elementary and secondary schools, the community colleges and universities.

TABLES

Table 1

County	No 1930	%	No 1940	%	No 1950	%	No 1960	%	No 1970	%	No 1980	%	No 1985	%	No 1990	%	No 2000	%
Apache	17.8	4.1	24.1	4.8	27.8	3.7	30.4	2.3	32.9	1.8	52.1	1.9	55.1	1.7	68.5	1.8	84.2	1.6
Cochise	41.0	9.4	34.6	6.9	31.5	4.2	55.0	4.2	62.8	3.6	85.6	3.2	94.6	3.0	106.9	2.7	129.0	2.4
Coconino	14.1	3.2	18.8	3.8	23.9	3.2	41.9	3.2	49.2	2.8	75.0	2.8	85.8	2.7	100.7	2.6	129.1	2.4
Gila	31.0	7.1	23.9	4.8	24.2	3.2	25.7	2.0	29.5	1.7	37.0	1.4	39.3	1.2	41.5	1.1	45.8	0.9
Graham	10.4	2.4	12.1	2.4	13.0	1.7	14.0	1.1	16.7	1.0	22.9	0.8	24.2	0.8	25.2	0.6	26.3	0.5
Greenlee	9.9	2.3	8.7	1.7	12.8	1.7	11.5	0.9	10.5	0.6	11.4	0.4	9.4	0.3	9.5	0.2	9.1	0.2
Maricopa	151.0	34.7	186.2	37.3	331.8	44.3	663.5	51.0	979.8	56.1	1509.3	55.5	1814.0	57.4	2276.8	58.2	3252.4	61.1
Mohave	5.6	1.3	8.6	1.7	8.5	1.1	7.7	0.6	26.3	1.5	55.9	2.1	73.7	2.3	85.8	2.2	108.4	2.0
Navajo	21.2	4.9	25.3	5.1	29.4	3.9	38.0	2.9	48.2	2.8	67.6	2.5	70.1	2.2	93.2	2.4	98.6	1.9
Pima	55.7	12.8	72.8	14.6	141.2	18.8	265.7	20.4	356.5	20.4	531.4	19.6	586.0	18.5	734.8	18.9	973.7	18.3
Pinal	22.0	5.1	28.8	5.8	43.2	5.8	62.7	4.8	69.4	4.0	90.9	3.3	99.9	3.2	116.3	3.0	149.1	2.8
Santa Cruz	9.7	2.2	9.5	1.9	9.3	1.2	10.8	0.8	14.1	0.8	20.5	0.8	22.9	0.7	31.7	0.8	39.8	0.7
Yavapai	28.5	6.5	26.5	5.3	25.0	3.3	28.9	2.2	37.6	2.1	68.4	2.5	86.4	2.7	104.2	2.7	140.2	2.6
Yuma/La Paz	17.8	4.1	19.3	3.9	28.0	3.7	46.2	3.6	61.5	3.5	88.8	3.3	108.5	3.1	95.4	2.8	130.9	2.5
TOTAL	435.5	100.0	499.3	100.0	749.6	100.0	1302.2	100.0	1795.0	99.6	2716.6	100.0	3160.6	100.0	3890.4	100.0	5320.7	100.0

Source: Bureau of the Census, 1930-1980, Arizona Department of Economic Security 1985, 1990, 2000.

Table 2

County of Origin, High School Graduates
1985-86 School Year

COUNTY	GRADUATES	PERCENTAGE
Apache	650	2.36
Cochise	923	3.35
Coconino	1,039	2.76
Gila	403	1.56
Graham	298	1.08
Greenlee	101	0.37
La Paz	122	0.44
Maricopa	15,127	54.90
Mohave	602	2.19
Navajo	899	3.26
Pima	4,695	17.04
Pinal	910	3.30
Santa Cruz	307	1.11
Yavapai	722	2.62
Yuma	753	6.44
TOTAL	27,551	100.00

Table 3

Community College Enrollments of First-time Entering Freshmen, Fall 1986 Who Were High School Graduates, 1986

COMMUNITY COLLEGE DISTRICT	1986 HIGH SCHOOL GRADUATES ENROLLED	PERCENTAGE
Cochise	237	3.34
Graham	301	4.24
Maricopa	4,930	69.49
Mohave	85*	1.19
Navajo	129	1.18
Pima	1,217	17.15
Pinal	94	1.32
Yavapai	N/A	-
Yuma/La Paz	101	1.42
TOTAL	7,094	100.00

*Estimated

Table 4

Enrollment of 1986 High School Graduates
in Public Universities, Fall, 1986 by County of Origin

COUNTY	ASU	NAU	U of A	TOTAL
Apache	13	28	16	57
Cochise	25	42	53	120
Coconino	14	171	71	256
Gila	13	22	13	48
Graham	3	6	3	12
Greenlee	4	1	3	8
La Paz	6	2	5	13
Maricopa	1,820	574	742	3,136
Mohave	21	56	22	99
Navajo	32	71	9	112
Pima	45	134	1,073	1,252
Pinal	24	20	27	71
Santa Cruz	7	13	37	57
Yavapai	31	54	42	127
Yuma	22	24	44	90
TOTAL	2,080	1,218	2,160	5,480